

# **Manufacturing e.g. long smooth composites by controlled differential pressure resin transfer molding requiring distortion-resistant mold sections with channels distributing resin to narrow-slot cavity entries**

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## **ABSTRACT**

Channels (6) beneath the molding surface (300) of the distortion-resistant mold section (3), extend over its length. They are connected to the molding surface. Preferred features: Bores or longitudinal slots (7) connect channels to the molding surface. Channel diameter is a multiple of connection width. At each end of the channels, valves (8, 9) control resin injection and sinking (16). In an otherwise similar development, injection tubes are inserted into the channels, having connections (slots or bores) into the mold cavity.

## **DESCRIPTION**

The invention concerns a device for the production of elements consisting of GRP components materials, of cooperating shaped parts, whereby at least a shaped part is trained formbestaendig according to the outline of the outside surface of the construction unit and a shaped part with connection means pressure-lowers for the injection of a resin and to is provided, whereby between the cooperating shaped parts a fiber clutch of eggs set is insertable.

The RTM (Resin transfer mol DIN g) procedure serves the production of construction units from GRP components materials. An evacuable form with cooperating shaped parts is used. At least one shaped part, i.e. that one which the outline of the outside surface of the construction unit illustrates, must a formbestaendiges shaped part be. A well-known technical solution uses a shaped part, which pressure-lowers the connection means for the injection of the resin and at opposite edges of the form-stable shaped part arranged (14th Oeffentl. Annual convention of the AVK e. V. in joy city, 4. to 6,10,1977, preprint P. 6-1 to 6-6).

On the inside of the shaped part longitudinal grooves are arranged in those the connection means flow. The resin is distributed by the grooves and the flow front of the resin flows through in the form fiber clutches of eggs present perpendicularly and parallel to the groove.

It is unfavorable that the outside surface of the construction unit illustrates determining shaped part of dead heads of the connections, which reduce the surface quality, since strong outline jumps arise.

A well-known device DE 195 36 675 c1, which present line elements on the formbestaendigen shaped part facing the surface of a fiber-putting set, eliminates this lack. Thus the connections in the shaped part

are void. After hardening the resin the line elements are connected by narrow bars with the construction unit, which are rear offable when removing the line elements in the surface of the construction unit. The employment of these line elements, which are to be arranged additionally in the form, is unfavorable.

Task of the invention is it, while stationary of the technology admitted disadvantages to avoid. The task solved by the characteristics requirement of the 1 or after another variant with the characteristics requirement 6.

Underneath the surface in the form-stable shaped part, whereby the surface is trained according to the outline of the outside surface of the construction unit, channels are arranged according to extending the shaped part, which are connected for extending the shaped part extending connection with the surface of the shaped part by means of along.

This connection between surface and channel can be out-arranged by a multiplicity of one behind the other arranged drillings. A particularly favourable arrangement would be to be designed the connection as narrow slot. The slot extends along the surface, which corresponds to the outline of the outside surface of the construction unit. It is avoided by the narrow slots that dead heads on the surface of the construction unit are formed, which strong outline jumps represent.

The expenditure of line elements is avoided at the same time, how it particularly with the DP (differential Pressure) RTM procedure is necessary. It is void also the expenditure that each there line element must be sealed opposite a shaped part wall and led outward.

A further advantage of the invention is that no castings of connection means for the resin injection and/or pressure-lower at the construction unit are illustrated.

This form-stable shaped part is mentioned with the RTM procedure at the same time the lower part of the form, also Unterform. Thus the advantage results that the entrance direction of the resin corresponds to the natural, ascending way of gases displaced out of the fiber clutch of eggs into the form, in particular from cavities which can be displaced. Thus remaining gas bubbles in the resin reduces.

After an arrangement are the channels favourable-proves with circular cross section trained. The selected cross section of the channels is not however on one determines form reduced. The channels serve the transport of the resin. Each channel is connected with a narrow slot with the surface of the shaped part already specified. The diameter of the channel is larger around a multiple than the width of the slot. Like the channel also the slot extends over largest extending (e.g. the longitudinal direction) of the shaped part.

Another variant makes the solution for the task possible as in the formbestaendigen shaped part slot (for example rectangular slot) is brought in, whereby then into this slot employments are insertable. The employments are there solvable positioned and fixed. They adapt positively to the groove. Such an employment is tubularly, for example with square cross section, whereby those carries turned surface of the employment a lengthwise-led slot for the form area. The employment represents the channel. Therefore the employment is connected also with the connection means specified already.

The channels are to side to controllable connection means for the injection of the resin and at the opposite side to controllable connection means to pressure-lower connectably. The connection means are with a control connected and with it steered closable or oeffenbar. Therefore pressure-lowers each second channel to be closed, but the resin injection can opened and with the remaining channels

pressure-lowers opened, but closed the resin injection. Thus an unhindered flow front of the resin becomes secured, which makes a complete impregnating possible of the fiber clutch of eggs. The availability of the shaped part for a renewed manufacturing step is favourably in shortest time and without cleaning expenditure of the slots realizable.

In the following the invention is described on the basis a remark example with design. It shows

Fig. 1 the principle of the device on the basis a cross section by a form with inserted fiber clutch of eggs,

Fig. 2 schematic representation formbestaendiges shaped part with controllable connection means,

Fig. 3 cross section of a exchangeable, tubular employment as channel in a formbestaendigen shaped part.

The device according to invention is applicable with the RTM procedure. A special procedure derived from it is the DP RTM procedure. The differences existing there do not limit the invention. Agreeing both use a formbestaendiges shaped part, which corresponds to the outline of the outside surface of the construction unit with its surface in the form area.

Fig. 1 shows schematizes a cross section by a form 1, consisting of the two cooperating shaped part 2 and shaped part 3. The shaped part 3 is a formbestaendiges shaped part, which illustrates the outline of the outside surface construction unit. The shaped part 2 can be just as form-stably trained, however it can be trained also as flexibly ductile shaped part. Each shaped part can be compound from a multiplicity of individual components. The shaped part 2 forms the upper form 20 and the shaped part 3 forms the Unterform 30. The shaped part 2 embraces the shaped part 3 and by means of a extent-laterally led seal 4 is hermetically sealable the form area 10. Both shaped parts 2, 3 are thus vacuum-tightly connectable. Between both shaped parts a fiber clutch of eggs set 5 is inserted 2, 3. In the formbestaendigen shaped part 3 channels 6 are trained. These channels extend under the surface of the shaped part toward its largest extending. Extending (z. B longitudinal extending) the shaped part corresponds also to extending (e.g. longitudinal extending) the construction unit. These channels are essentially parallel to each other led. Each channel 6 is connected by means of a connection 7 with the surface 300. The connection 7 can be formed for example by drillings along the channel 6 or by along the channel 6 running gap with width b. The gap represents the connection 7. After Fig. 1 is connected to each channel 6 by means of by the entire length of the shaped part of 3 extending, narrow slot (gap) with the surface 300 of the formbestaendigen shaped part 3. The slot has width a b of approximately 1 mm. The diameter of a channel 6 is larger a multiple (for instance the eightfold) than the width b of the gap.

The connections 8 for injection lines 81 are installed on the external wall of the shaped part 3 and flow in the appropriate channel. The connections 8 are - like Fig. 2 shows - controllable, i.e. the supply of the reaction resin mass 810 held in the liquid condition is controllable. For this purpose the individual connection means can be out-arranged 8 as controllable flow valve. The controlling of the resin flow takes place for example via an electrical control 14 of the flow valve. From the control 14 control lines lead 140 to the connection means 8.

The control 14 of the flow valve works with a control program. The control 14 can be a component of a superordinate press control 15. The controlling of the reaction resin mass is thus temporally variable possible. The river of the reaction resin mass is preferably supplyable or interruptible

The connection means 8 are connected with the injection lines 81, the reaction resin mass supply. This reaction resin mass is well-known and resin is briefly called. On the other one, opposite side of the external wall of the shaped part 3 are at each channel 6 a further, controllable connection means 9 for pressure-lower 16 intended, which flows in the channel 6. The controllable connection means 9 is likewise connected with the control 14 by means of control lines 141. At the connection port 9 it concerns likewise a controllable flow valve. Thus the individual vakuumsleitung can be opened closed or

By means of pressure-lower 16 a vacuum one produces, which affects the attached channels 6

By means of the control 14 for example resin could be supplied to each second channel 6, as the connection means 8 is opened there, which is closed appropriate connection means 9 in the same channel 6 and which have remaining channels 6 the connection means 8 closed, but the associated connection means 9 for pressure-lower 16 opened.

The flow front of the injected resin induces itself to vakuumsleitungen 91 with opened connection means 9. By the temporally variable attitude of the controllable connection means 8 and 9 an optimal flow front of the resin is produced.

The fiber clutch of eggs is impregnated with the resin and afterwards follows the step of the hardening by precipitation.

Fig. 3 shows schematizes a excerpt-wise cross section of the shaped part 3. The surface 300 of the shaped part 3 has slot 11. These extend along the largest expansion direction of the surface 300. In favourable way are essentially to each other parallel led the slot 11. Into each groove 11 an employment 12 is assigned. The employment 12 has an opening 13, which is so positioned that it flows into the form area 10. This opening 13 can be trained as slot with the width b or as through-holes arranged in row. The connection means 8, 9, which flow in the employment 12, are not represented.

Each employment 12 can positively completely into a groove be inserted. The employment is preferably form stable, but flexible.

With the fact the advantage results that the shaped part is available after hardening and taking the construction unit in shortest time and without cleaning expenditure of the slot for a new manufacturing step.

## CLAIMS

1. Device for the production of elements consisting of GRP components materials, of cooperating shaped parts, whereby at least a shaped part is trained formbestaendig according to the outline of the outside surface of the construction unit and a shaped part with connection means pressure-lowers for the injection of a resin and to is provided, whereby between the cooperating shaped parts a fiber clutch of eggs set is insertable by the fact marked that underneath the surface (300), which according to the outline the outside surface of the construction unit is trained in the formbestaendigen shaped part (3), channels (6) according to extending the shaped part is intended and that the channels (6) with the surface (300) of the formbestaendigen shaped part (3) are located in connection.

2. Device according to requirement 1, by the fact characterized that the connection (7) between channel (6) and surface (300) is formed for extending the channel (6) by drillings along.

3. Device according to requirement 1, by the fact characterized that the connection (7) is formed for running gap by in each case along the channel (6).
4. Device according to requirement 1, by the fact characterized that the diameter of a channel (6) is larger a multiple than the width (B) of the connection (7).
5. Device according to requirement 1, by the fact characterized that the channels (6) reciprocally to controllable connection means (8, 9) for the injection of the resin and pressure-lower (16) are connectable.
6. Device for the production of elements consisting of GRP components materials, of cooperating shaped parts, whereby at least a shaped part is trained formbestaendig according to the outline of of the outside surface of the construction unit and a shaped part with connection means pressure-lowers for the injection of a resin and to is provided, whereby between the cooperating shaped parts a fiber clutch of eggs set is insertable, by the fact characterized that in the shaped part (3) according to its extending slots (11) are arranged in its surface (300), whereby in each groove (11) a tubular employment (12) with an opening (13) is used, which flows into the form area (10):
  7. Device according to requirement 6, by the fact characterized that the opening (13) when slot with width (B) is trained.
  8. Device according to requirement 6, by the fact characterized that the opening (13) when in row arranged through-holes is trained.
  9. Device according to requirement 6, by the fact characterized that the diameter of the tubular employment (12) is larger a multiple than the opening is (13).
  10. Device according to requirement 6, by the fact characterized that the employment is connectable (12) with controllable connection means flowing there (8, 9).



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Fig. 1

